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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/693,982	10/28/2003	Kenji Kawai	67161-126	3978

7590 12/14/2005

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EXAMINER
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TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 12/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/693,982	KAWAI, KENJI	
	<b>Examiner</b>	<b>Art Unit</b>	
	Binh X. Tran	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10-28-2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10-28-03, 10-26-05</u> | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 1-2, 4-5, the term "thin" is subjective vague and indefinite. It is unclear from the claim, what is the specific thickness that applicants consider as "thin".

Claims 3-7 are indefinite because they directly or indirectly depend on indefinite claim 1.

There are two different magnetic layers (a magnetic layer and another magnetic layer) in claim 5. Therefore, it is unclear from the claim whether "the magnetic layer" (line 8 of claim 5) refer to the first magnetic layer, the second magnetic layer or both.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section

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351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 3 are rejected under 35 U.S.C. 102(b) as being anticipated by Shoji (US 5,853,602).

Respect to claim 1, Shoji discloses a method of dry-etching a multi-layer film material including a metal film (tungsten) using a gas containing a carbonyl group (CO gas), a gas containing halogen element (i.e. Cl<sub>2</sub>), an electron donating gas (i.e. SF<sub>6</sub>) (See col. 3-4). Respect to claim 3, Shoji discloses the electron donating gas is SF<sub>6</sub>.

5. Claims 1, 3 are rejected under 35 U.S.C. 102(e) as being anticipated by Son et al. (US 2004/0038547 A1).

Respect to claim 1, Son discloses a method of dry-etching a multi-layer film material (22, 24, 26) including a metal film (24) using a gas containing a carbonyl group (CO gas), a gas containing halogen element (i.e. CHF<sub>3</sub>, CH<sub>2</sub>F<sub>2</sub>, SF<sub>5</sub>, NF<sub>3</sub>, C<sub>4</sub>F<sub>8</sub>, C<sub>5</sub>F<sub>6</sub>, BCl<sub>3</sub> etc), an electron donating gas (i.e. CF<sub>4</sub>) (See paragraph 0028-0029). Respect to claim 3, Son discloses the electron donating gas is CF<sub>4</sub>.

6. Claims 1, 3 are rejected under 35 U.S.C. 102(e) as being anticipated by Ying et al. (US 6,943,039).

Respect to claim 1, Ying ('039) discloses a method of dry-etching a multi-layer film material including a metal film (60) using a gas containing a carbonyl group (CO gas), a gas containing halogen element (i.e. CHF<sub>3</sub>, Cl<sub>2</sub>), an electron donating gas (i.e. CF<sub>4</sub>) (col. 3 line 65 to col. 4 line 10). Respect to claim 3, Ying ('039) discloses the electron donating gas is CF<sub>4</sub>.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ying US 6,943,039 in view of Li et al. (US 2003/0134513).

Respect to claim 2, Ying ('039) discloses a method of dry-etching a multi-layer film material including a metal film (60) using a gas comprises a gas containing a halogen element (i.e. CHF<sub>3</sub>, Cl<sub>2</sub>), an inert gas (i.e. Ar), an oxygen gas (O<sub>2</sub>), a carbonyl group (CO gas), an electron donating gas (i.e. CF<sub>4</sub>) (col. 3 line 65 to col. 4 line 10). Ying fails to disclose an ozone gas. However, Ying clearly teaches to use oxygen gas as one of the component. In an etching method, Li teaches to use oxygen derived from the group of O<sub>2</sub>, O<sub>3</sub> (ozone) and a mixture thereof (paragraph 0028). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ying in view of Li by including ozone because equivalent and substitution of one for the other would produce an expected result.

9. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ying (US 6,943,039) in view of Ying (US 6,964,928) and further in view of Rulkens et al. (US 6,919,279).

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Respect to claim 4, Ying ('039) fails to disclose the multi-layer film have three layer structure of a magnetic film, a tunnel barrier layer, and another magnetic layer. However, Ying ('039) clearly teaches a random access memory comprise a multi-layer structure film having at least three layer structure. In a random access memory, Ying ('928) teaches to form three-layer structure of a magnetic film (112), a tunnel barrier layer (116), and another magnetic layer (114). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ying ('039) in view of Ying ('928) by having magnetic film, a tunnel barrier layer, and another magnetic layer because this structure will help to create magneto-resistance random access memory (MRAM).

Ying ('928) further disclose the tunnel layer (116) is used as an etch stop layer for the dry etching process (col. 4 lines 45-50). An etch stop layer must be exposed before stopping the etching process. This teaching read on the limitation of "stopping etching the tunnel barrier layer". However, Ying ('928) fails to disclose the specific endpoint detection technique for the etch stop layer. In a dry etching process, Rulkens discloses that the CO gas generated during the etching can be use to accurately detect the end point (col. 7-8). Since a lot of CO gas was generated nears the end point, the flow rate of CO gas must be increased. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ying ('039) and Ying ('928) by detecting an increase in the flow of CO gas because this technique will accurately detect the endpoint by measuring CO spectral emission.

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10. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ying (US 6,943,039) in view of Ying (US 6,964,928).

Respect to claim 5, Ying ('039) fails to disclose the multi-layer film have three layer structure of a magnetic film, a tunnel barrier layer, and another magnetic layer. However, Ying ('039) clearly teaches a random access memory comprise a multi-layer structure film having at least three layer structure. In a random access memory, Ying ('928) teaches to form three-layer structure of a magnetic film (112), a tunnel barrier layer (116), and another magnetic layer (114). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ying ('039) in view of Ying ('928) by having magnetic film, a tunnel barrier layer, and another magnetic layer because this structure will help to create magneto-resistance random access memory (MRAM).

Ying ('928) further disclose the tunnel layer (116) is used as an etch stop layer for the dry etching process (col. 4 lines 45-50). Ying ('928) also discloses a pattern of the magnetic layer (112) formed in a former dry etching process prior to the step of stopping etching (See Fig 4).

Respect to claim 6, Ying ('928) teaches to remove polymers film (124) at the sidewall of the pattern formed by dry etching by using a rinse solution comprises ammonium hydroxide (aka ammonia) or deionized water (col. 5 lines 11-25, Fig 2). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ying ('039) in view of Ying ('928) by removing the polymer film formed on the sidewall because it will help to remove residues on the metal stack structure.

Respect to claim 7, as discussed above, Ying ('928) teaches to remove polymers film (124) at the sidewall of the pattern using rinsing solution. Ying further discloses the polymer residues (124) comprises metallic chloride, metallic fluoride, metal-containing polymer (col. 4 lines 12-20). The removed residues (124) is present in the rinsing solution, therefore the specific gravity of the solution must be changed. Further, since the residues (124) contain metallic salt (i.e. metallic chloride, metallic fluoride), the electric conductivity of the rinsing solution must be changed. This change certainly can be measured or observed. It also can be used to detect the endpoint of a cleaning process.

### ***Conclusion***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should



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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*Binh Tran*

Binh X. Tran